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**NUTRIENT INTAKES OF THE ENLISTED PERSONNEL ABOARD
THE USS SARATOGA BEFORE AND AFTER IMPLEMENTING "FAST FOOD"
TO THE FOOD SERVICE SYSTEM**

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**Nutrient Intakes of the Enlisted Personnel Aboard the USS Saratoga Before
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storage space caused rapid exhaustion of fresh milk supplies and reduced calcium and riboflavin intakes. In 1978, vitamin A fortified milk shakes (dry base) and vitamin C fortified extruded French fried potatoes and vitamin C fortified non-carbonated beverages were provided with the "Fast Food" meals. These items improved the crew's consumption of calcium, riboflavin, and vitamin A and C. The cholesterol, animal fat, percent fat calories, and energy content of the average "Fast Food" meal did not exceed that of the average full course meal.

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ABSTRACT

A test of "Fast Foods" for Navy afloat feeding was conducted aboard the aircraft carrier USS Saratoga. A diary-interview technique was used by the team from Letterman Army Institute of Research to evaluate the nutrient intakes of 203 enlisted sailors before (July - August 1977) and 150 sailors after (November 1978) a "Fast Food" system was implemented in the forward galley. The aft galley continued to serve full course meals. The short order meals served forward in 1977 were low in vitamins A and C. Limited refrigerated storage space caused rapid exhaustion of fresh milk supplies and reduced calcium and riboflavin intakes. In 1978, vitamin A fortified milk shakes (dry base) and vitamin C fortified extruded French fried potatoes and vitamin C fortified non-carbonated beverages were provided with the "Fast Food" meals. These items improved the crew's consumption of calcium, riboflavin, and vitamins A and C. The cholesterol, animal fat, percent fat calories, and energy content of the average "Fast Food" meal did not exceed that of the average full course meal.

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The Department of Defense (DOD) has long recognized that a primary responsibility is to provide its personnel with the opportunity to consume wholesome and appetizing foods that, as a diet, provide the essential nutrients to promote nutritional health, physical fitness, and mental well being. The Secretary of the Army has the responsibility for executing a DOD Food Research, Development, Testing and Engineering Program to support foods and food related research and development activities for the tri-services. The U.S. Army Materiel Command serves as the developing agency for the foods and food service portions of the program and the U.S. Army Natick Research and Development Command (NARADCOM) is the performing laboratory. The Surgeon General of the Army serves as the developing agency for the nutrition and wholesomeness portion of the program and Letterman Army Institute of Research (LAIR) was the performing laboratory. A tri-service Joint Formulation Board integrates all requirements from the military services and assigns priorities to the requirements.

The Department of Navy requested a systems analysis of their food service system afloat. They asked that alternatives to the existing system be developed to achieve increased user acceptance, greater efficiency of operations, reduced cost, reduced manpower requirements, and an improvement in the food service environment. The Operations Research/Systems Analysis Office at NARADCOM was assigned the primary responsibility for the study. The Division of Nutrition Technology at LAIR was tasked to assess the adequacy of the nutrient intakes of Navy personnel in shipboard situations, provide recommendations to improve nutritional health, and evaluate the nutritional impact of any revised food service system. The aircraft carrier USS Saratoga CV-60 was selected for the study. Food service on this class ship is challenged with most types of problems related to crew feeding at sea.

PURPOSE

The purpose of this study was to assess the nutritional impact of the new fast food system installed and operated on the USS Saratoga CV-60 during its 1978 - 1979 Mediterranean cruise. Additionally, LAIR was tasked to assess the adequacy of the nutrient intakes of Navy personnel in the shipboard situation and provide recommendations to improve their nutritional health. The study was conducted by the Division of Nutrition Technology, Letterman Army Institute of Research (LAIR).

METHODS

The study was conducted in two phases. Phase 1 (before 'Fast Food') to evaluate the existing food service system was conducted aboard the USS Saratoga during the initial weeks of its 1977 Mediterranean cruise. Food consumption data were collected during the following distinct periods:

12 - 20 July -- transit Mayport, Florida to Rota, Spain.

25 - 29 July -- anchorage off Rota, Spain.

30 July - 7 August -- operations in the Mediterranean.

Phase 2 (after 'Fast Food') to evaluate the new food service system implemented by NARADCOM (1) was conducted during the period 13 - 20 November 1978 during operations in the Mediterranean. The USS Saratoga following food service renovation had deployed from Mayport, Florida on 2 October 78. Thus the new system had been in continuous operation for approximately six weeks prior to the study.

Subject Selection

Subjects were selected by department chiefs to provide a sample of the Ship's Company and Air Wing. This represented approximately 5% of the crew members grades E-6 and below, stratified by rank, division assignment, and work shift. The 203 subjects in phase 1 and 150 subjects in phase 2 were briefed as to the purpose of the study and measures used to insure confidentiality of individual data. Different individuals were studied during each phase, with the exception of three subjects who participated in both phases.

Data Collection and Processing

Food consumption, demographic and anthropometric data were collected on each subject. A dietary diary-interview technique, developed by LAIR (2), was used to collect and evaluate 17 days of food intake data during phase 1 and 7 days of data during phase 2. At the initial interview the participants were randomly assigned to one of three interviewers. Interviewers instructed the participants to itemize on pocket-sized diary cards all food and beverages (except water) consumed daily. Guidance was also provided on how to record TIME (hour), WHERE (aft or forward galley, gedunk, soda mess, etc.), and QUANTITY (in household units, pkg., wt.). The importance of recording consumption information as soon as possible was emphasized. At 3 to 4-day intervals, subjects returned completed diary cards to

the interviewer for review of completeness, assistance in estimating portion size, identification of any unusual food items, and assignment of each food item as a component of either a meal or between-meal snack. The LAIR Nutrient Factor File (NFF), which is a data base of nutrient composition values obtained from various sources (3, 4, 5) for over 1200 food items, was used to compute nutrient intake. The Recommended Daily Allowances for military personnel (6) were used as standards for the evaluation of nutritional adequacy of individual diet intakes.

Each interviewer coded and verified the data obtained from his assigned participants. Each food item was assigned a Food Identification Number (FIN) found in the NFF. Recipes for complex food items (e.g., casseroles, soups), were obtained from the ship's cook and ship's recipe file. Nutrients for that item were computed from nutrient values for the individual ingredients. Average daily nutrient intakes, from all sources, were computed for each subject. Average nutrient intake from all aft and forward galley meals for each subject as well as, average nutrient intakes for breakfast, lunch, and dinner meals from aft and forward galleys were computed.

The nutrient intake data were expressed on a nutrient density basis by using the concept of Nutrient Ratio (NR):

$$NR = \frac{\text{Intake of nutrient expressed per 1000 kcal}}{\text{Nutritional standard expressed per 1000 kcal}}$$

The data were reduced by categorizing the nutrient intakes as either "low" (less than 70% of standard), "marginal" (between 70% and 100% of standard), or "adequate" (greater than 100% of standard). The nutrient standards used to compute the nutrient ratios were derived by dividing the Military Dietary Allowance (MDA) for each nutrient per day by the daily allowances for calories. The MDA are based upon the National Research Council (NRC) Recommended Dietary Allowance (RDA) (7).

The NR concept is a useful tool to evaluate and compare the nutritional adequacy of meals consumed by individuals from various sources such as the aft and forward galleys.

Demographic (age, rank, duty assignment, work shift, and activity level) and anthropometric (height, weight, skinfold thickness) information were obtained on each subject. Skinfolds were measured during phase 1 at right and left triceps and subscapulas. During the data collection of phase 2 and four months later, near the completion

of the Mediterranean cruise, the skinfolds were measured at the right triceps, biceps, subscapulas, and suprailiac. All measurements were made by the same investigator using Lange skinfold calipers. Each subject was compared to the Navy weight for height standards (8) and his percent body fat was estimated using Durnin-Womersley's equation (9). Weight change data of each phase 2 participant was assessed to check the caloric adequacy of the meals consumed from the new food service system. Some crew members reported that they 'always' lost weight on such cruises; therefore, the data were evaluated to determine the validity of the statement.

RESULTS

Utilization

During phase one of the study a persistent problem of long lines at aft galley meals existed. Attracting customers to the forward galley, thereby reducing the amount of time spent standing in line at the aft galley, was one of the goals of changing the food service system. Improving the dining environment and introducing "Fast Foods" were the changes implemented to increase the utilization of the forward galley.

Comparisons of galley selection patterns, based on the average number of meals eaten at each galley, and percent utilization before and after "Fast Foods" are shown in Table 1. The average number of meals consumed per day did not change; however, the percentage of meals consumed at the forward galley was markedly increased from 23% before "Fast Foods" to 38% after introducing "Fast Foods." Further breakdown of attendance data is shown in Table 2. The average number of breakfast meals (0.50) before and (0.48) after "Fast Foods" were unchanged. Similarly, the mean number of lunch meals (0.68) before and (0.70) after "Fast Foods" did not change. Dinner attendance, however, increased after "Fast Foods" from 0.64 to 0.73 meals, while the number of late night (midrat) meals decreased from 0.18 to 0.08 meals. The percentage of forward galley meals eaten during the second phase increased more than 50% at breakfast meals, 60% at lunch meals and 113% at dinner meals when compared to percentage of meals eaten in the forward galley during phase 1. Figure 1 shows a comparison of the percent utilization of each galley at each meal. Before "Fast Foods" the percent utilization of the aft galley was more than doubled that of the forward galley. However, after "Fast Foods" the percent utilization of both galleys at breakfast and dinner meals was nearly equal. The aft galley was used more at lunch (19% vs. 12%) than the forward galley.

Sub-populations were created using demographic characteristics to assess further the utilization data. Figures 2-5 clearly show that the "Fast Foods" concept was well accepted by all of the sub-populations evaluated. Although individuals from all ranks increased their utilization of the forward galley after "Fast Foods" (Table 3), the forward galley was favored by the junior pay grades and, hence, younger sailors (Figure 3). Petty Officers First Class (E-6) and subjects in the "over 30" age group demonstrated a preference for the aft galley at all meals.

Demographic and Anthropometric

Demographic comparison of the test populations of both phases of the study are shown in Table 4. Distributions by rank, department, age, marital status, and activity level were quite similar for both phases and approximate that of the entire crew. Distribution by work shift show an 18% increase in the number of subjects working the day shift while the number of subjects with variable work schedules decreased 17% during phase 2.

Anthropometric summaries (Tables 5 and 6) show 25% and 15% of the populations were overweight in phases 1 and 2, respectively. The means of the percent body fat of the two populations were not different ($19.47\% \pm 5.06$ vs. $18.51\% \pm 4.80$). Likewise, the subsequent skinfold measurements of 118 of the phase two subjects showed 18.4 percent body fat. Table 7 presents the anthropometric results on 118 subjects who participated in the two part phase 2 study. The mean weight change of the test population was $-0.35 \text{ kg} \pm 2.0$ and there was no change in percent body fat. Four-month weight change data (Table 8) show that 62.0% of the population had changes of less than four pounds, 25.0% lost more than four pounds and 14.0% gained more than four pounds. Those subjects with weight losses showed significant ($p < .01$) reductions in percent body fat from $21.9\% \pm 3.5$ to $20.7\% \pm 3.6$. Subjects who gained weight had a tendency ($p = 0.14$) to increase their percent body fat from $19.1\% \pm 6.1$ to $19.8\% \pm 5.3$. The numbers of aft and forward galley meals eaten by those subjects in the three groups were not significantly different from each other. The test population was categorized according to the weight for height standards (7). Quartiles were formed by subdividing minimum and maximum weights for a given height into four narrow ranges or quartiles (Table 9). Of those individuals who lost more than four pounds over the four month period, 45% were categorized in either the fourth quartile or overweight group.

Nutrient Intake (Phase 1 Before "Fast Foods")

As shown in Table 10, the population studied obtained only about 19% of their daily calories from the forward meals compared to 67% from aft meals. Table 11 shows average nutrient intakes for aft and forward meals. Note the differences in intake between the two meals ($p < .01$) with respect to vitamin A (2105 ± 1296 vs. 854 ± 586 IU) and ascorbic acid (31.5 ± 14.7 vs. 15.1 ± 13.5 mg).

The percentage of the population with "low, marginal, or adequate" average daily intakes of 8 important nutrients are shown in Table 12. The average daily intakes of 20.7% of the population were "low" in vitamin A and 7.4% were "low" in vitamin C. None of the individuals had "low" intakes of protein and the incidence of those with "low" intakes of the other nutrients was 1.5% or less.

An evaluation of meals consumed in the aft and forward galley is shown in Table 12. Only 8.9% and 2.0% of the population consumed meals served in the aft galley that had "low" vitamin A and vitamin C concentrations, respectively. Only, 5.4% of the individuals had "low" calcium intakes. However, in the forward galley 69.0% of the studied population studied consumed meals with "low" amounts of vitamin A, 48.9% with "low" amounts of vitamin C, and 16.8% with "low" calcium concentrations. In addition, 4.9% of the study group consumed meals "low" in niacin concentration.

Nutrient ratio analyses of daily totals (Table 12) indicate that only 77%, 46%, 70%, 73% and 77% of the test population received adequate amounts of calcium, vitamin A, thiamin, riboflavin and vitamin C. As shown in Figure 6, food service exhausted its supply of fresh milk on 15 July, received fresh supplies of milk while in port and ran out again on 31 July. The consumption of non-dairy beverages increased when milk was not available. On a daily basis, the percentage of the population with "low" intakes of calcium (Figure 7) and riboflavin (Figure 8) increased on those days (15 to 20 July and 31 July to 7 Aug) when fresh milk was not available.

Average nutrient intakes from breakfast, lunch, and dinner meals comparing the aft and forward galley are shown in Table 13. Nutrient intakes at breakfast meals for the aft galley were greater ($p < .01$) than nutrient intakes from forward galley breakfast meals, with the exception of vitamin C which was not different. Likewise, compared to forward meals, aft lunch and dinner meals contained higher ($p < .01$) nutrient concentrations for most nutrients. Iron intakes for lunch and dinner were greater ($p < .05$) at aft galley meals compared to

forward galley meals. Calcium intakes at lunch and dinner meals were not different. Percent fat calories, cholesterol, and animal fat were greater ($p < .01$) at forward lunch and dinner meals.

Table 14 show an evaluation, based on NR, of breakfast, lunch, and dinner meals at the forward and aft galleys. A higher incidence of "low" vitamin A and vitamin C concentration occurred at forward meals than at aft meals. At forward dinner meals, 78.3% and 66.5% of the studied population consumed meals that had "low" amounts of vitamin A and vitamin C, respectively. Similiar, observation were noted for the forward galley lunch meals, with 75.3% and 64.4% of the individuals consuming meals "low" in vitamin A and vitamin C concentrations. However, at aft galley lunch and dinner meals, 28.9% and 15.9% of the individuals had "low" intakes of vitamin A, while only 9.1% and 6.7% had "low" concentrations of vitamin C, respectively. Forward galley breakfast meals had a greater incidence of "low" amounts of each of the eight nutrients evaluated, compared to aft galley breakfast meals. At forward galley breakfast meals, 37.5% of the individuals had meals "low" in vitamin A, 44.2% had meals "low" in vitamin C, 80.8% "low" niacin intakes, 31.7% reported "low" iron concentrations and 16.3% had meals "low" in calcium. Aft breakfast meals, in contrast, had 10.6% of the population consuming meals "low" in vitamin A, 31.1% "low" in vitamin C and 43.9% "low" in niacin concentrations.

The studied populations consumed an average of 13.9% of their calories from sources other than meals at the two galleys (Table 10). The nutritional evaluation based on nutrient ratio of the food consumed from non-galley sources is shown in Table 15. The foods and beverages obtained from these other sources were primarily carbonated beverages and snack items. The nutrient levels of these foods were less than adequate for 75% or more of the populations, with the exception of calcium which was adequate for 42% of the populations.

Evaluating the eating habits of subjects with "low", "marginal", and "adequate" intakes of vitamin A (Table 16) shows those individuals with adequate intakes of vitamin A in their daily diets receive 24% more of the daily calories from aft galley meals. Additionally these individuals receive fewer calories from snacks 10% compared to individuals with "low" intakes of vitamin A who receive 19% of the daily calories from snacks. Evaluating vitamin A intakes of aft and forward meals show individuals with "low" daily vitamin A intakes with a vitamin A ratio for an average forward meal of only 0.77 compared to 1.97 for aft meals.

Examination of food type selection (Table 17) shows that individuals with "low" vitamin A intakes selected fewer foods rich in dietary vitamin A than those individuals with "adequate" vitamin A intakes. The "low" vitamin A group consumed no liver, 98% fewer carrots, and 81% fewer green leafy vegetables than the group with adequate vitamin A intakes.

Nutrient Intake (Phase 2 After "Fast Foods")

During phase 2, after "Fast Foods," the studied population obtained about 30.0% of their calories from "Fast Food" meals compared to 70.0% at the aft galley. Table 18 shows average nutrient intakes for aft and forward galley meals. Percent fat calories, ($44.7\% \pm 6.0\%$) from forward ("Fast Food") meals were less ($p < .01$) than ($47.9\% \pm 5.7\%$) per aft galley meal. Likewise, the mean cholesterol intake (196 ± 73 mg) from the forward galley meal was less ($p < .01$) than the mean cholesterol intake (332 ± 158 mg) from aft galley meals. Mean nutrient intakes of iron (8.4 ± 2.5 mg), vitamin A (2463 ± 1307 IU), and vitamin C (31.2 ± 21.3 mg), were greater ($p < .01$) from aft galley meals than the average intakes of iron (6.9 ± 2.3 mg), vitamin A (1931 ± 1114 IU), and vitamin C (26.8 ± 19.1 mg) from the forward galley "Fast Food" meals. Average calcium intakes were not different from meals at the two galleys. The percentages of the population with "low, marginal, or adequate" average daily intakes of 8 important nutrients are shown in Table 19. The average daily intakes of 12.0% of the population were "low" in vitamin A and vitamin C and 6.0% of the individuals had "low" amounts of thiamin in their diets. None of the individuals had "low" intakes of protein and the incidence of individuals with "low" intakes of the other nutrients were 0.7%.

An evaluation of aft galley meals consumed during phase 2 (Table 19) shows 9.7% of the population had meals with "low" amounts of vitamin A, while 16.7% consumed meals with "low" vitamin C concentrations. Furthermore, 6.3% of the individuals who ate aft galleys meals received "low" levels of thiamin, 1.4% had "low" riboflavin intakes, and 2.1% consumed meals with "low" calcium concentrations. There were no incidence of "low" protein intakes from aft meals. An evaluation of forward galley meals, however, shows 28.6% and 25.7% of the population consuming meals with "low" amounts of vitamin A and vitamin C, respectively. Also, the incidence of "low" amounts of calcium, iron, thiamin, riboflavin, and niacin occurred in meals consumed by 4.3%, 5.7%, 2.9%, 2.1%, and 1.4% of the studied population, respectively.

Average nutrient intakes from breakfast, lunch, and dinner meals comparing the aft and forward galleys are shown in Table 20. Aft breakfast meals showed a 75% greater ($p < .01$) intake of protein and a 20% higher ($p < .05$) calcium intake than forward breakfast meals. However, forward breakfast meals provided 43% and 50% ($p < .01$) greater intakes of vitamin A and niacin, and 41% ($p < .01$) greater intakes of vitamin C compared to intakes from aft breakfast meals. Aft galley protein and iron intakes for lunch meals were greater ($p < .01$) than "Fast Food" lunch meals. However, the other nutrient intakes were not different at lunch meals. Vitamin A intakes at aft galley dinner meals were greater ($p < .01$) than the forward galley "Fast Food" meals; however, the other nutrients were not different. Percent fat calories and cholesterol intakes were greater ($p < .01$) at the aft galley at each meal than forward galley meals. Percent animal fat was not different at lunch and dinner meals from each galley; however, percent animal fat at aft breakfast meals was greater than ($p < .05$) forward breakfast meals.

Table 21 shows an evaluation, based on NR, of breakfast, lunch, and dinner meals at the forward and aft galleys. A higher incidence of "low" vitamin A and vitamin C concentrations was found at forward rather than aft galley meals. At forward galley lunch meals, 48% and 35% of the population had "low" levels of vitamin A and vitamin C, respectively. Likewise, forward galley dinner meals had 40% and 29% of the individuals with "low" levels of vitamin A and vitamin C, respectively. Aft breakfast meals showed 52% of the population had "low" concentration of vitamin C compared to forward breakfast meals where only 18% had meals "low" in vitamin C concentrations. Similarly, 46% of the population eating aft breakfast meals had "low" concentrations of niacin compared to 20% at the forward galley meals. The incidence of "low" vitamin A concentrations at breakfast meals were similar for forward and aft meals (13% vs. 12%).

A list of foods and beverages provided in the forward galley during the second phase of the study is shown in Table 22. Almost all of the dry cereals served were vitamin and mineral fortified. Cheeseburgers, hamburgers, French fried potatoes, and the beverages were offered at all lunch and dinner meals. Usually two types of submarine sandwiches were served at lunch. One or more selections of fish, chicken, pizza, or shrimp were offered at dinner. Food service was temporarily out of the vitamin C fortified fruit punch during the survey period. Our data reflect the non-fortified beverage base that was served during this period.

It must be emphasized that vitamin fortification significantly affected the nutritional adequacy of the forward galley meals and total daily nutrient intakes. As shown in Table 23, fortified foods contributed 20% of the vitamin A and 23% of the vitamin C consumed each day. Since all of the milk shakes, French fried potatoes, and approximately 65% of the fortified dry cereals were consumed at meals served at the forward galley, the contribution of fortified foods was approximately 30 to 35% of the totals received from this galley. If milk shakes and soft serve ice cream had not been fortified with vitamin A, the incidence of men having "low" average daily vitamin A intakes would have been 25.3% instead of 12.0%. Similarly, if the French fried potatoes had not been fortified with vitamin C, 35.3% instead of 12.0% would have had "low" daily intakes of vitamin C. If the fortified fruit punch had been available and consumed at the same level as the non-fortified beverage, the incidence of men with "low" vitamin C intakes would have been 8.7% instead of 12.0%.

The beverage selection patterns of individuals when they consumed "Fast Foods" or full course type meals are reflected in Table 24. Only 50% of the individuals who ate at least one lunch meal at the forward galley during the 7-day period selected a milk shake with a meal. Further analyses, not shown on the table, indicated that 39.3% of the population did not consume a milk shake during the entire 7-day study. Carbonated beverages were less popular than non-carbonated beverages with the forward galley meals, and especially with the full course meals served at the aft galley.

Some selected food type preference data from the forward galley lunch and dinner meals are shown in Table 25. When available, 64% of the lunch patrons selected a cheeseburger as a part of their meal. BBQ sandwich was selected by 42% of the patrons when it was served at one lunch meal. Selection rates indicate that chicken, pizza, and shrimp were equally popular and more popular than either submarine sandwiches or hot dogs. Milk shakes and non-carbonated drinks were selected more than milk or carbonated beverages at lunch and dinner meals in the forward galley.

A before and after comparison of the aft galley meals which were not directly affected by the "Fast Foods Test" is shown in Tables 12 and 17. The incidence of "low" vitamin C intakes was higher (16.7%) for phase two compared to only 2.0% for phase one. Likewise, the incidence of "low" thiamin intakes increased from 0.5% to 6.3% of those eating aft galley meals. The incidence of "low" calcium intakes in the population

decreased from 5.4% to 2.1%. Other nutrient intakes were comparable between the two phases at the aft galley.

Marked differences in the nutritional adequacy of the forward galley meals were noted after the introduction of "Fast Foods" as shown in Tables 12 and 17. The incidence of men reporting "low" vitamin A intakes decreased from 69.0% to only 28.6% and the incidence of those having "adequate" vitamin A intakes increased from 10.9% to 44.3%. The incidence of "low" intakes of vitamin C decreased from 48.9% to 25.7%. There was an increase in the incidence of "adequate" intakes of calcium from 52.2% to 92.4%. Likewise, riboflavin intakes increased with 82.9% of the men having "adequate" amounts during the second phase while only 55.4% had "adequate" riboflavin intakes during the first phase from meals at the forward galley.

An evaluation of the average daily nutrient intakes before and after "Fast Foods" is shown in Tables 12 and 19. The percentage of individuals with "adequate" calcium intakes increased from 77.3% for phase one to 96.7% for phase two. Likewise, the incidence of those with "adequate" riboflavin intakes were increased from 73.4% to 88.7%. After introduction of "Fast Foods," the incidence of men with "low" vitamin A intakes decreased from 20.7% to 12.0%. However, the incidence of those having "low" intakes of vitamin C increased from 7.4% to 12.0%.

DISCUSSION

Utilization

The addition of "Fast Foods" to the food service system was well accepted by the crew. The number of meals per subject per day were the same during both phases of the study (Table 1), while utilization of the forward galley during phase 2 more than doubled at dinner meals from phase 1 (Table 2). The forward galley remained open for dinner meals until 2200 hours during the second phase, compared to 2000 hours during the first phase. These longer hours may have drawn some customers away from the midrats meal (2300 to 0200 hours), accounting in part for the much greater utilization of the forward galley at dinner meals after introducing "Fast Foods." However, the increased utilization of the forward galley was observed for all meals. Since the breakfast menu was essentially the same during each phase, it is possible that the modified decor and change in dining atmosphere attracted the crew. During phase 2, attendance at both aft and forward galleys was essentially equal; however, at lunch, the aft galley with its full service menu was used more than "Fast Food" forward galley (Figure 1).

Categorizing the test population based on demographic characteristics (Figures 2-5), demonstrate that the new food service system was well-accepted by all sub-populations in the studied population. While Petty Officers, First Class (E-6), increased their utilization of the forward galley (Table 3) these senior pay grade and hence, older sailors ("over 30" group, Figure 3) demonstrated a preference for the aft galley at all meals. It should be noted that First Class Petty Officers were not required to stand in the aft serving line with junior pay grade personnel and had the privilege of eating his meal in an enclosed lounge off the aft mess deck. The availability of the First Class lounge undoubtedly contributed to the higher aft and lower forward galley utilization by the E-6's.

Demographic

The individuals making up the groups studied in the two phases of this study were different. However demographically the two groups were quite similar (Table 4). During phase 2; however, there were more subjects working the day shift and less people working a variable shift. This difference from phase 1 work shifts may have provided a study population with a "more normal" daily routine. That is, a routine compatible with eating regular meals at the traditional times (e.g., breakfast in the morning, lunch at midday, dinner in the evening).

Anthropometry

Estimates of percent body fat (Tables 5 - 6) show that the phase 2 test population had 10% fewer overweight subjects. Overweight subjects are defined as: individuals who exceed the Navy's weight for height standards. At this time, however, there is no reason to conclude that the difference in the percentage of the subjects who exceed the Navy's weight for height standards was due to the change in food service. There was no change in the number of meals per week (Table 7) and 62% of the subjects (Table 8) maintained their body weight during the second phase cruise. Of those who lost weight over the four-month period (Table 9), 45% were found to be in the fourth quartile or overweight group. It is not unconceivable that some of these men were dieting. Therefore, the caloric adequacy of the diets of the test group, with "Fast Foods" as a component of the food service system, will not adversely affect the crew. It will require a longitudinal study to project what effect the Navy afloat food service system has on the existing overweight problem in the Navy.

Nutrition

During both phases of the study considerable differences existed in the type of foods served at the aft and forward galleys. Before "Fast Food" the aft galley offered full course meals at breakfast, lunch and dinner. The forward galley, in contrast, offered a continental breakfast and short order type lunch and dinner meals comprised of hot dogs, grilled cheese and cold cut sandwiches, ravioli, chile, and fried chicken. Vegetables and salads were seldom served at these meals.

Expressing nutrient intake data on a nutrient density basis by using the concept of Nutrient Ratio (NR) is a useful tool to evaluate and compare the nutritional adequacy of meals consumed by individuals from various sources such as aft and forward galleys. Average daily intakes were also evaluated using the NR concept. However, it is important to recognize that the incidence of "low" average daily nutrient intakes does not mean the incidence of nutrition deficiency in the population. However, low average daily intakes of a specific nutrient can be used to estimate the percentage of a population that may have reduced body stores of that nutrient. If these individuals continue their reported patterns of food selection and dietary habits, they may risk developing nutritional deficiencies. However, the incidence of nutritional deficiency in a population can be confirmed only by a comprehensive clinical examination and a biochemical assessment of nutritional status.

During phase one, the incidence of "low" concentrations of vitamin A and vitamin C (Table 12) in 20.7% and 7.4% of the population indicated a potential nutritional problem. Comparing eating habits of individuals with "low, marginal, and adequate" intakes of vitamin A (Table 16) shows that individuals with "low" vitamin A intakes received 25% of their calories from the forward galley compared to only 14% for those with "adequate" vitamin A intakes. Also, individuals with "low" daily vitamin A intakes received nearly twice the percentage of daily calories from snacks compared to those subjects with "adequate" amounts of vitamin A in their daily diets; 19 to 10%, respectively. Snack type items (carbonated beverages, candy, etc.), often described as providing "empty calories," are poor sources of nutrients other than energy as indicated by the high incidence of low nutrient intakes.

A nutritional problem related to insufficient refrigerated storage space was indentified during the first phase of the study. Supplies of fresh milk were sufficient for only four to seven days. As shown in Figure 6, food service exhausted its supply of fresh milk

on 15 July, received fresh supplies of milk while in port, and ran out again on 31 July. The consumption of carbonated and non-carbonated beverages increased when milk was not available. Reconstituted non-fat dry milk was offered only at continental breakfast and was not well accepted. On a daily basis, the percentage of the population with "low" intakes of calcium (Figure 7) and riboflavin (Figure 8) increased on those days (15 to 20 July and 31 July to 7 August) when milk was not available.

Evaluating vitamin A intakes of the aft and forward meals show individuals with "low" daily vitamin A intakes with a vitamin A ratio of only 0.73 for aft meals. Therefore, poor selection of foods directly contributes to the vitamin A problem. An average forward meal vitamin A ratio of only 0.77 for the group with "adequate" daily vitamin A intakes demonstrates that even individuals with good food habits were unable to obtain adequate amounts of vitamin A when they ate at the forward galley. Therefore, the vitamin A content of the forward galley meals had to be increased, so that an increased utilization of the forward galley would not increase the incidence of "low" and "marginal" daily vitamin A intakes.

Food items that are good sources of dietary vitamin A and the consumption data of these food items were examined to obtain suggestions on how to increase vitamin A consumption. As shown in Table 21, individuals with "low" vitamin A intakes almost totally exclude carrots, sweet potatoes, and liver from their diets, all excellent sources of dietary vitamin A. Serving these items more frequently is not likely to have much effect on these men. They also consume lesser amounts of other good sources of vitamin A such as tomato products, leafy green vegetables, and various melons, peaches, and plums. Dairy products were reasonably well accepted by these individuals and was selected for fortification. French fried potatoes were also consumed in nearly equal quantities by each of the three groups.

When the decision was made to implement and test a "Fast Food" system in the forward galley of the USS Saratoga, LAIR recommended that the vitamin A and vitamin C content of the meals be increased and that milk or milk products be available to the crew at all times. NARADCOM incorporated a low fat milk shake (reconstituted aboard ship from a dry base) as a regular component of the lunch and dinner meals in the forward galley. LAIR recommended that the milk shake base be fortified with vitamin A to provide approximately 30% of the USRDA per serving. Additionally, this product was used to make soft serve ice cream. Adding a salad bar including carrot sticks and tomatoes was

recommended. It was also suggested that the citrus fruits and juices should be offered more frequently and a vitamin C fortified beverage base should be used to prepare the non-carbonated beverage. In addition, NARADCOM decided to fortify the extruded French fried potatoes with vitamin C.

The nutritional adequacy of diets from which a high proportion of the daily calories come from "Fast Foods" has created some concern within the medical and nutritional communities. As shown in Tables 12 and 17, there were marked reductions in the incidence of "low" intakes of vitamin A, vitamin C, and calcium in the "Fast Food" meals consumed at the forward galley during phase two compared to forward galley meals during phase one, while aft galley meals demonstrated only moderate differences. Therefore, the forward galley's "Fast Food" meals appeared to be nutritionally adequate.

Comparison between aft and forward galley meals consumed during the second phase of the study is shown in Table 19. Nutrient Ratio analyses indicate the nutritional adequacy of the aft and forward galley meals were comparable with the exception of somewhat greater incidences of "low" intakes of vitamin A and iron in the forward galley.

The average nutrient intake data from the second phase of the study are shown in Table 16. There were general differences in the average intakes per meal from the two galleys. Forward meals were somewhat lower in percent fat calories, cholesterol, iron, vitamin A and vitamin C. However, there was no difference in calcium intakes. The milk served during this study was obtained in Europe and was estimated to contain about 4% fat compared to normally supplied whole milk from the United States containing 3.3% fat. If 3.3% fat whole milk had been served, the percent fat calories of the daily diet would have been 42.6% instead of 43.8%, and if 2% fat milk had been served, percent fat calories would have been 40.7%, a value close to the military's goal of less than 40% of calories coming from fat sources.

Comparisons of cholesterol intakes at breakfast, lunch, and dinner meals from the aft and forward galley during the second phase are shown in Table 18. Additionally, the contributions of animal, plant and fish fat to total fat are shown. Average energy intakes and the percent fat calories were lower at each forward meal. The cholesterol intake from the aft breakfast meal (482 mg) was much greater than that from the continental breakfast (91 mg) in the forward galley. The difference reflects that eggs were consumed with the aft breakfast, but were not served with the continental breakfast in the

forward galley. Compared to aft galley lunch and dinner meals, cholesterol intakes were slightly lower at the forward galley. At forward galley meals, the percentage of fat derived from animal sources (mostly saturated) was not greater than at comparable aft galley meals. It is unlikely, therefore, that the type of "Fast Foods" served will increase the cholesterol or saturated fat consumption of the crew.

CONCLUSIONS

Nutrient intake data obtained during the two studies on the USS Saratoga indicate that the nutritional health of the crew will not be adversely affected by introducing "Fast Foods" as a component of the Navy Afloat Food Service System. The cholesterol, animal fat, percent fat calories, and energy content of the average "Fast Food" meal consumed at the forward galley did not exceed that of the average full course meal consumed at the aft galley. However, because of the low concentrations of vitamins A and C in the foods that comprise the usual "Fast Food" lunch or dinner meal, a modest fortification program is needed to prevent low intakes of vitamins A and C by individuals who obtain a large proportion of their daily calories from "Fast Food" meals. Fortification of milk shakes with vitamin A and the extruded French fried potatoes and non-carbonated beverage with vitamin C was demonstrated to reduce the incidence of low daily intakes of these important nutrients. The low fat milk shake prepared from a dehydrated base will also provide a highly acceptable source of calcium and riboflavin when fresh milk is not available.

RECOMMENDATIONS

Vitamin A and vitamin C fortification programs should be continued. Our data indicate that without vitamin A fortified milk shake more than 25% of the population may have "low" intakes of vitamin A. Likewise, without vitamin C fortified extruded French fried potatoes, it is probable that 35% of the population could have had "low" intakes of vitamin C. Use of vitamin C fortified non-carbonated beverage base should be continued. In addition, the dry potato base should be vitamin A fortified. This will help insure that individuals who otherwise avoid vitamin A rich foods (e.g., carrots, sweet potatoes, liver) will obtain some vitamin A in a food they are likely to prefer (French fried potatoes).

Offer at forward galley meals salad bar food items that are good sources of both vitamins A and C: mixed vegetables, broccoli, carrot sticks, bell peppers, or mixed salads containing carrots and dark leafy green vegetables, like spinach .

Provide either a dieter's plate or reduced portion sizes or nutritional guidance for dieters. Anthropometric data indicated that 15 to 25% of the populations studied exceeded the Department of Navy weight for height standards. The over-weight individuals lost weight during our survey period, whereas those who were within the standard maintained their body weights.

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APPENDIX A

PERCENT UTILIZATION DINING FACILITIES
JULY-AUGUST 1977 VS. NOV 1978

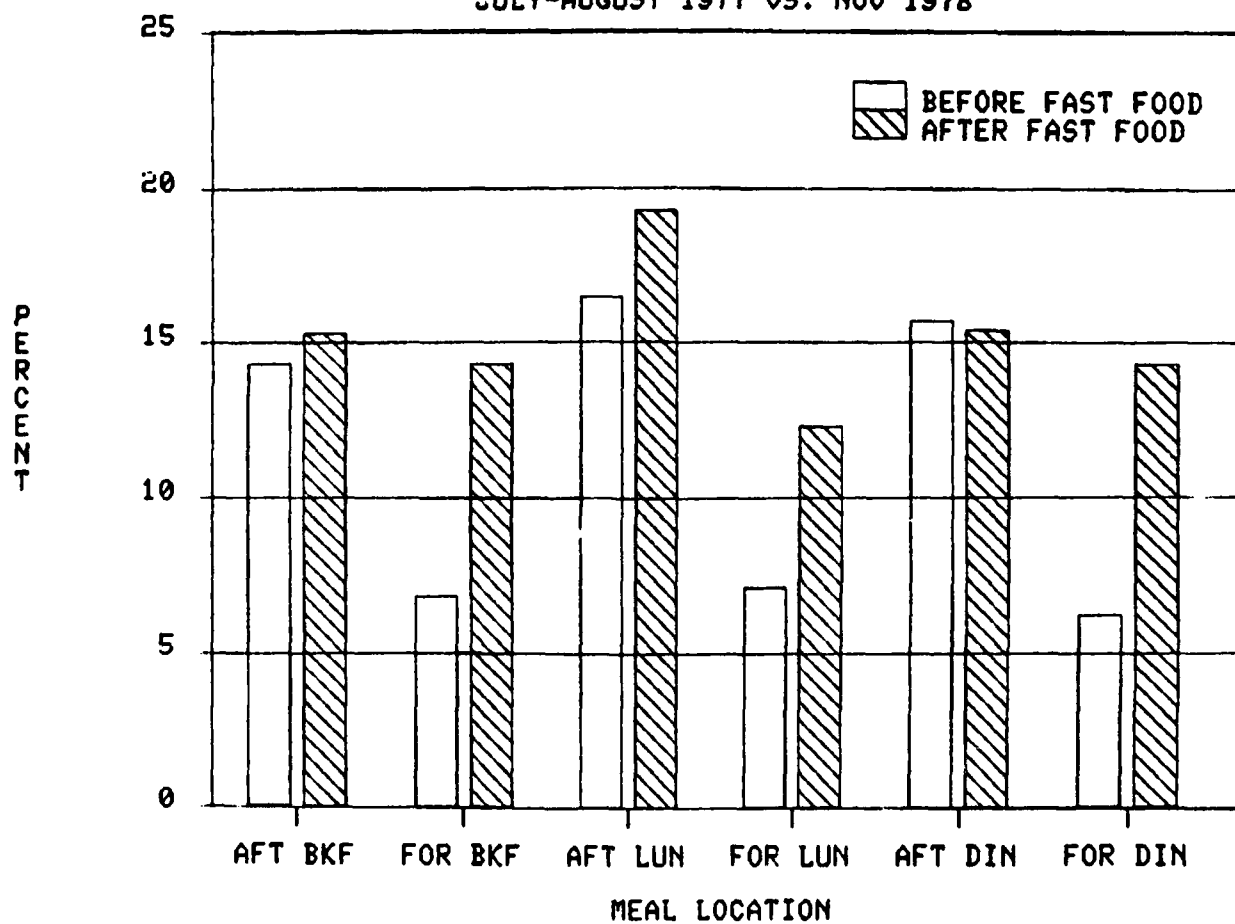


Figure 1 Percent Utilization of the Aft and Forward Dining Facilities for Breakfast, Lunch and Dinner Before and After Fast Food.

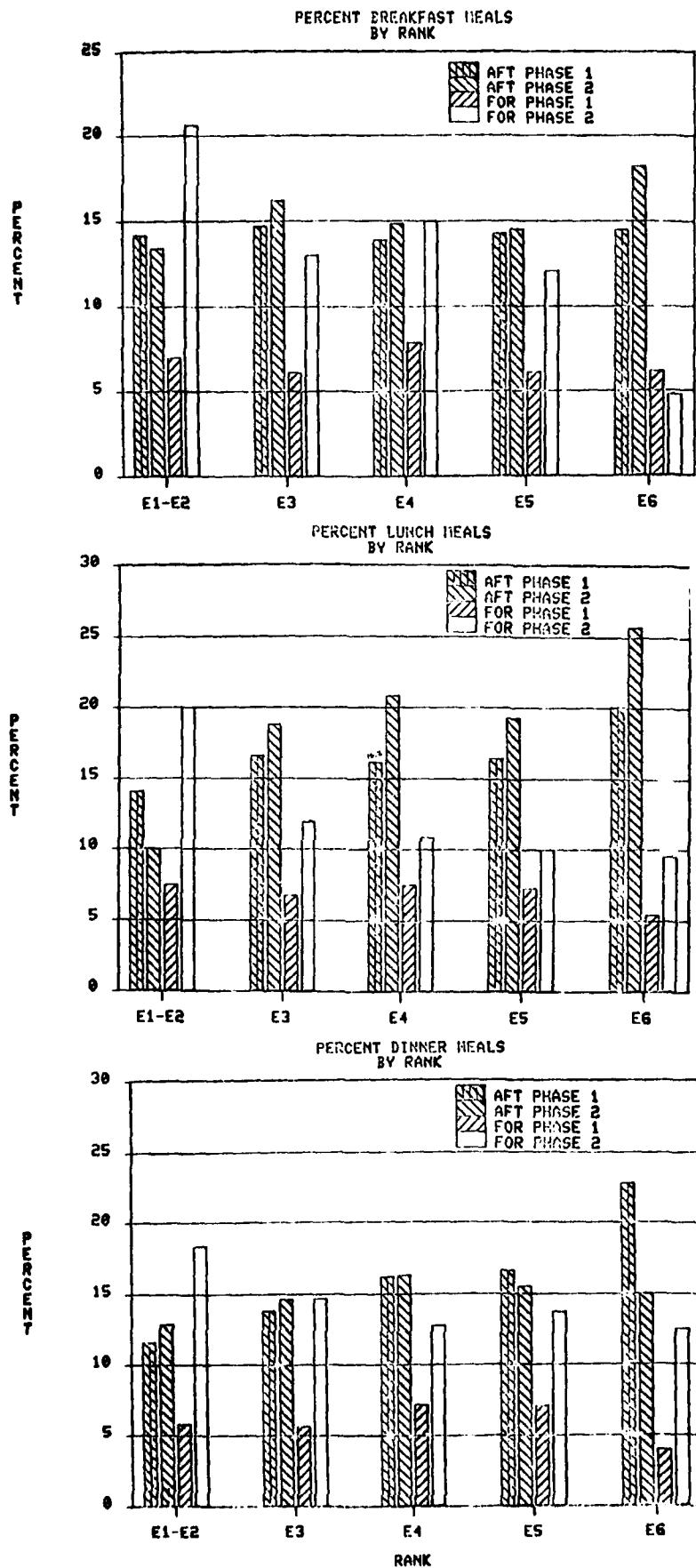


Figure 1. Percent utilization of the aft and forward bays for breakfast, lunch, and dinner before and after Fast Foods by rank.

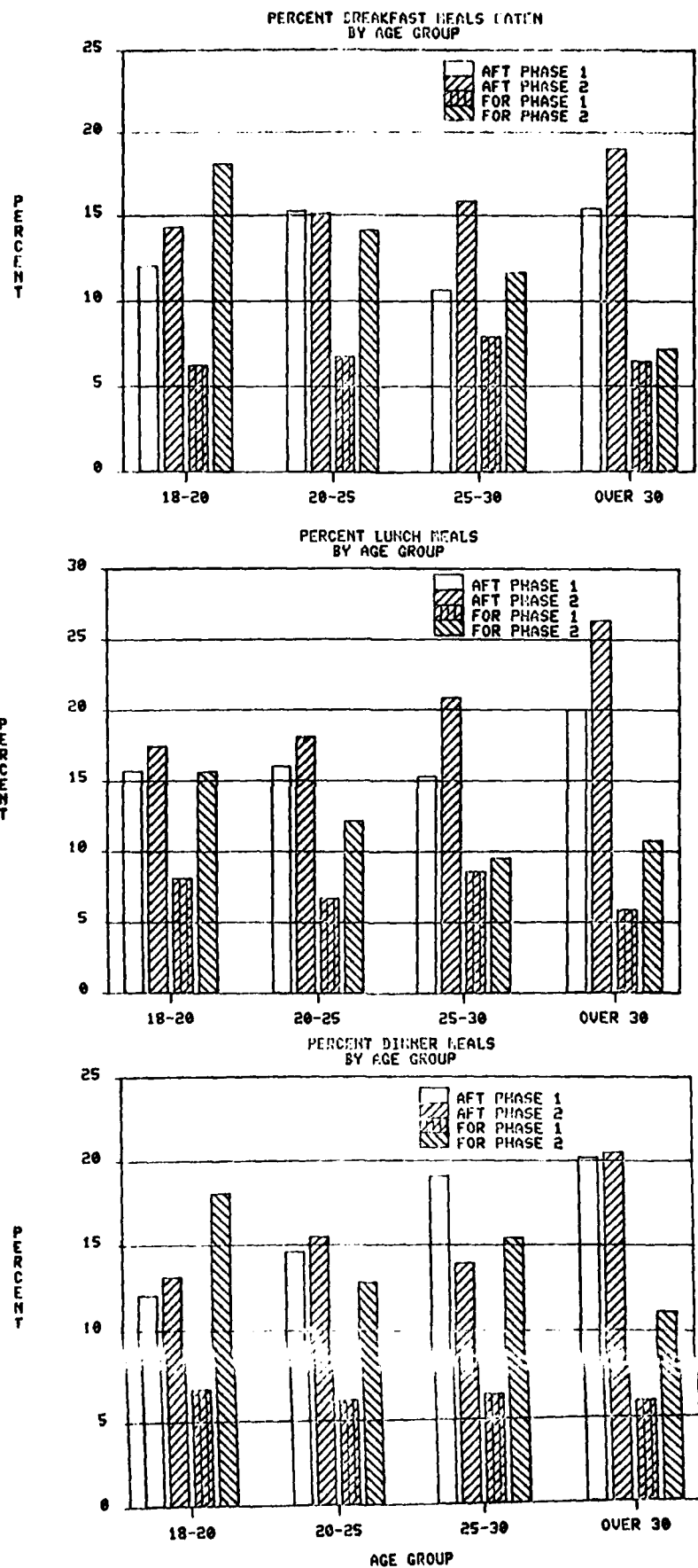


Figure 3 Percent Utilization of the Aft and Forward Galleys for Breakfast, Lunch and Dinner Before and After Fast Foods by age.

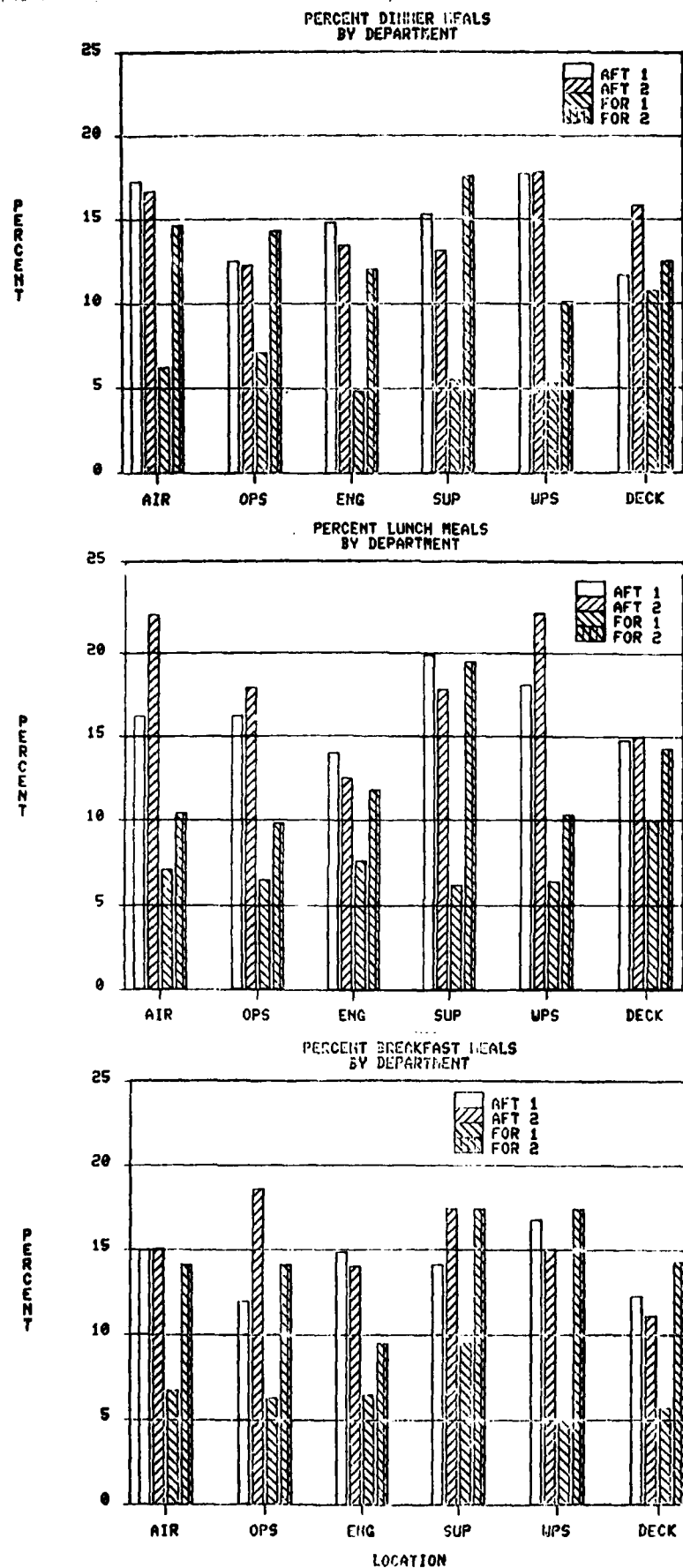


Figure 1 - Percent Utilization of the Aft and Forward Messes for Breakfast, Lunch and Dinner Before and After Fast Foods by Department.

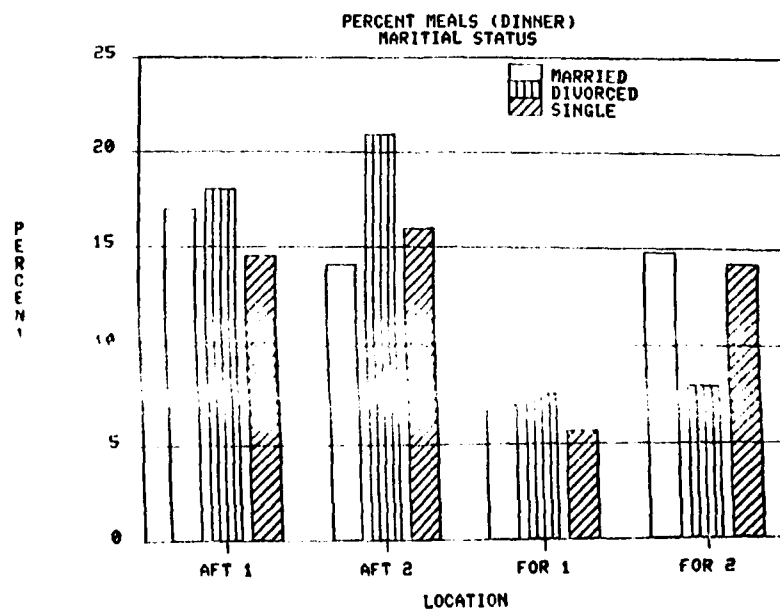
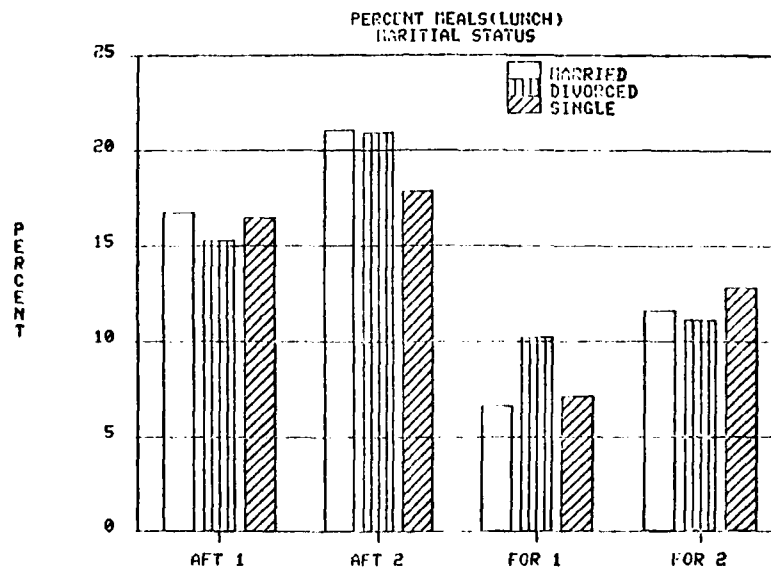
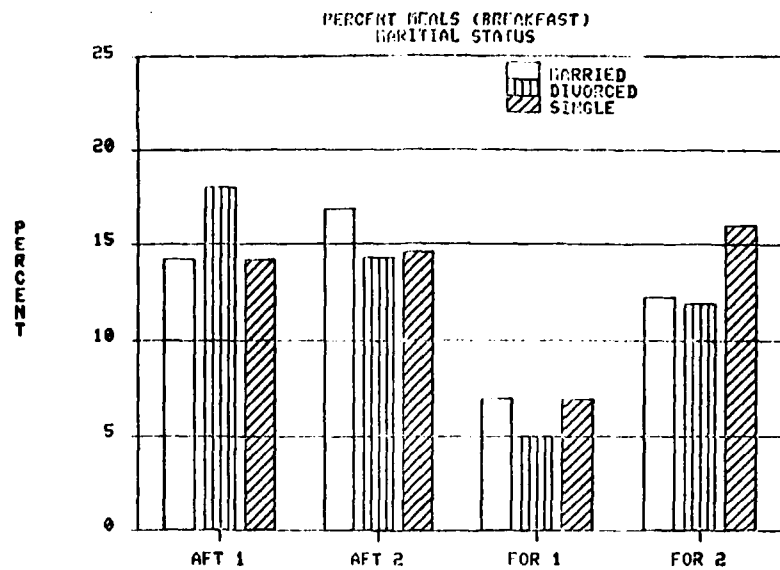


Figure 3 Percent Utilization of the Aft and Forward Galleries for Breakfast, Lunch and Dinner Before and After Fast Foods by marital status.

FIGURE 6

DAILY CONSUMPTION OF MILK AND NON-DAIRY BEVERAGES
USS SAPATOGA 1977

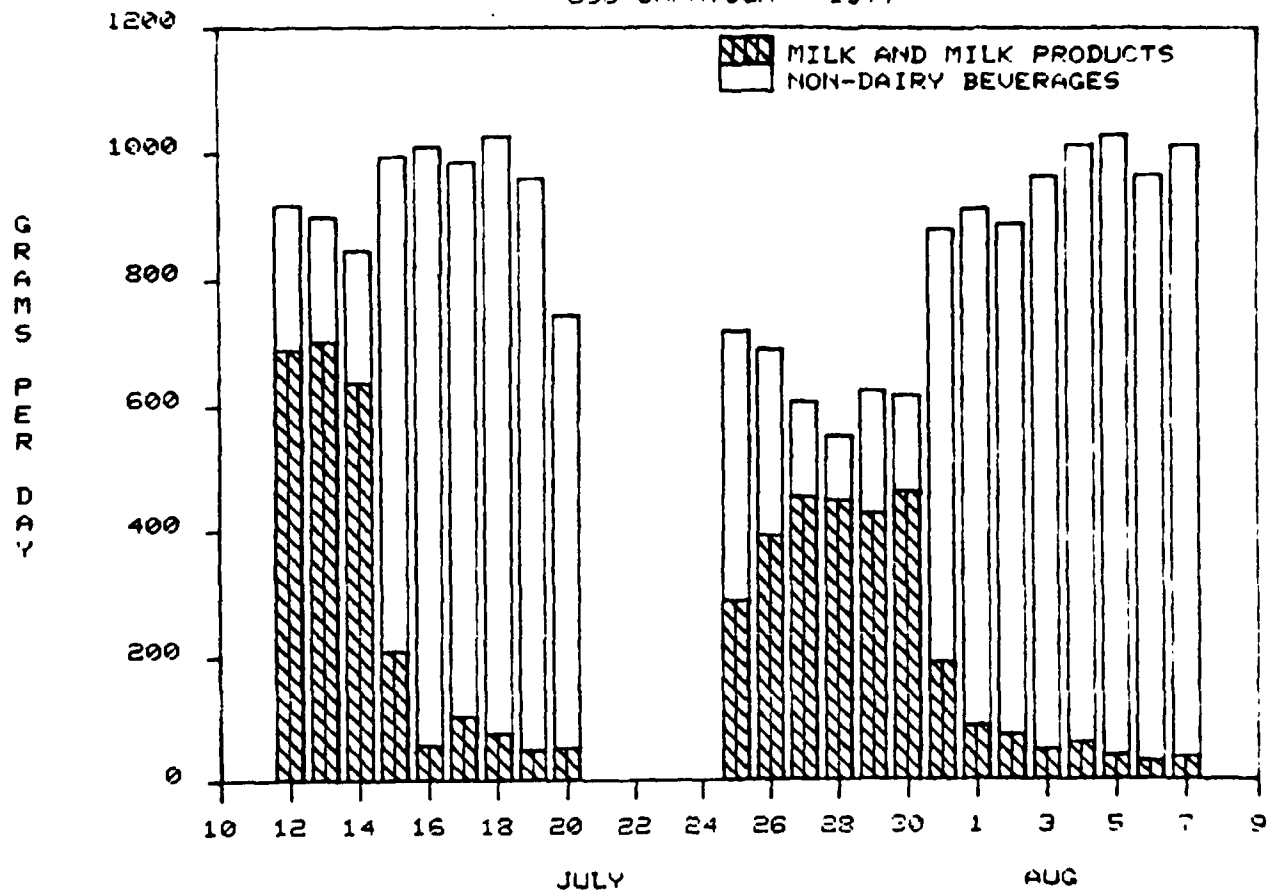


FIGURE 7

INCIDENCE OF LOW DAILY CALCIUM INTAKES
USS SARATOGA JULY - AUGUST 1977

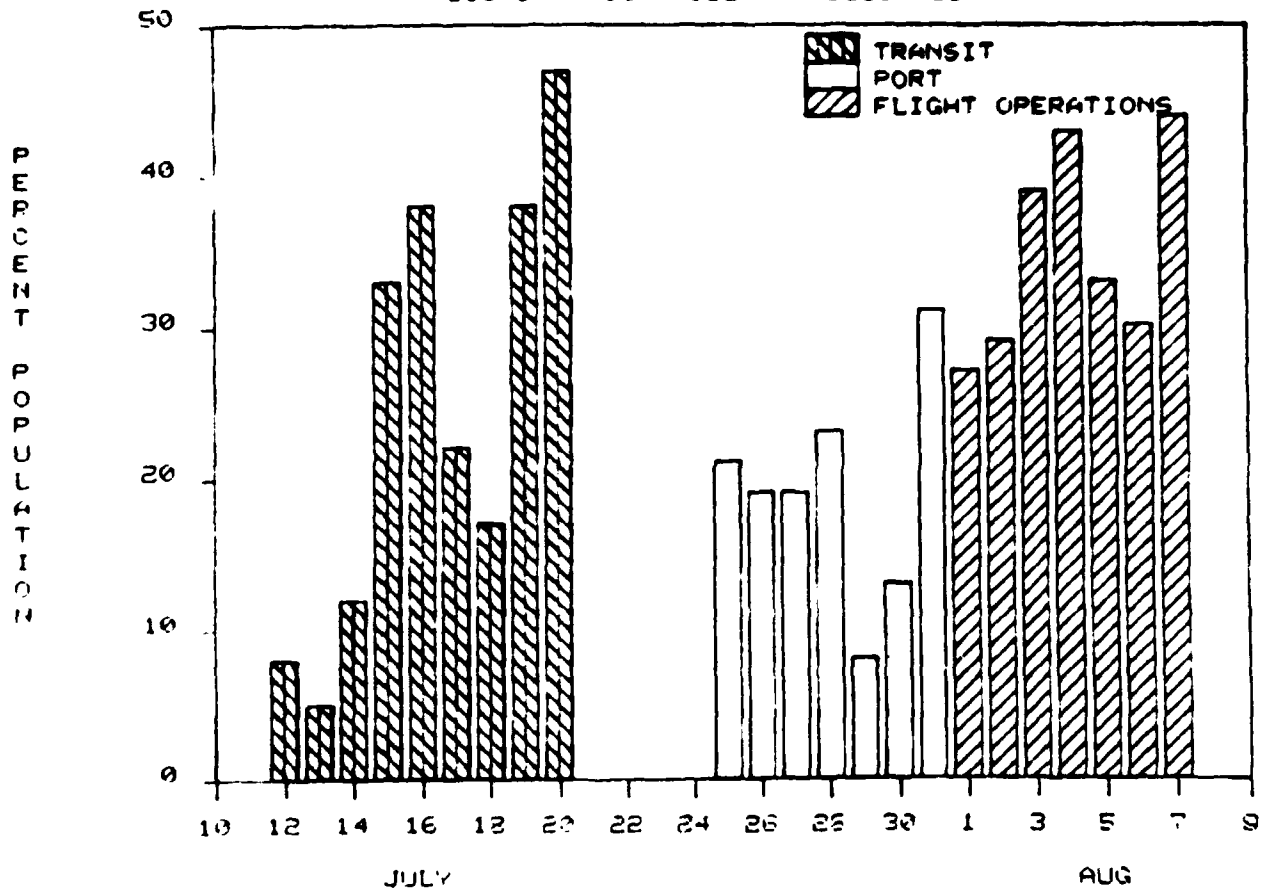
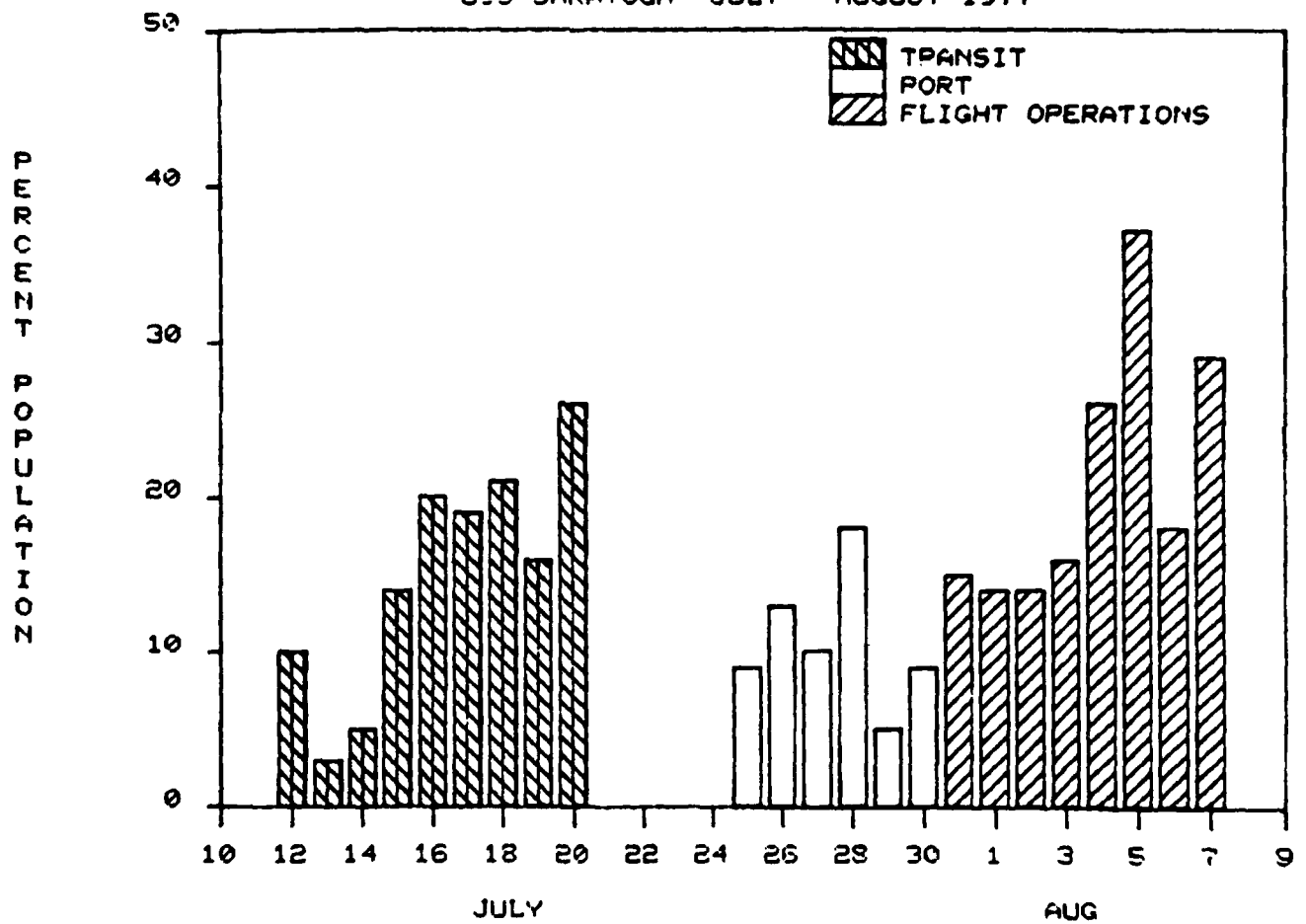


FIGURE 8
INCIDENCE OF LOW DAILY RIBOFLAVIN INTAKES
USS SARATOGA JULY - AUGUST 1977



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TABLE 1 GALLEY SELECTION PATTERNS
USS SARATOGA "FAST FOODS" TEST

Location	<u>MEALS PER DAY</u>	
	Before "Fast Foods" ¹	After "Fast Foods" ²
Aft Galley	1.48 ³	1.23 ³
Forward Galley	0.46	0.77
Gedunk ⁵	0.05	<0.01
Other ⁵	0.05	<0.01
Total Meals	2.03	2.00

¹ Jul - Aug 1977 Study, 3176 man-days of data from 203 subjects obtained during Atlantic transit and Mediterranean operational periods (part time not included).

² Nov 1978 study, 1044 man-days of data from 150 subjects obtained during a Mediterranean operational period.

³ Mean.

⁴ Percentage of total meals.

⁵ Includes meals consumed by Food Service personnel whole working in Wardrooms.

TABLE 2 MEAL AND GALLEY SELECTION PATTERNS
USS SARATOGA "FAST FOODS" TEST

MEAL PERIOD		MEALS PER DAY		
Location	Before "Fast Foods" ¹		After "Fast Foods" ²	
Breakfast	0.50 ³		0.48 ³	
Aft Galley	0.38	(76%) ⁴	0.33	(68%) ⁴
Forward Galley	0.11	(21%)	0.15	(32%)
Gedunk and Other	0.01	(3%)	<0.01	
Lunch	0.68		0.70	
Aft Galley	0.48	(71%)	0.44	(63%)
Forward Galley	0.15	(23%)	0.26	(37%)
Gedunk and Other	0.4	(6%)	<0.01	
Dinner	0.64		0.73	
Aft Galley	0.45	(71%)	0.37	(51%)
Forward Galley	0.15	(23%)	0.36	(49%)
Gedunk and Other%	0.03	(5%)	<0.01	
Midrats (Aft Galley)	0.18		0.08	

¹ Jul-Aug 1977 Study, 3564 man-days of data from 203 subjects obtained during Atlantic transit, port and Mediterranean operational periods.

² Nov 1978 Study, 1044 man-days of data from 150 subjects obtained during a Mediterranean operational period.

³ Mean.

⁴ Percentage of meals taken during a meal period at a location.

TABLE 3 INFLUENCE OF RANK ON FORWARD GALLEY UTILIZATION
USS SARATOGA "FAST FOODS" TEST

Rank	<u>Forward Galley Utilization</u> ¹	
	Before "Fast Foods" ²	After "Fast Foods" ³
E-1, E-2, E-3	23.9% (91) ⁴	44.5% (68)
E-4	25.2% (57)	32.9% (42)
E-5	22.9% (31)	38.7% (27)
E-6	8.3% (24)	18.7% (13)

¹Number Forward Galley meals ÷ number of total meals eaten x 100.

²Jul-Aug 1977 Study, 3564 man-days of data from 203 subjects obtained during Atlantic transit, Port, and Mediterranean operational periods.

³Nov 1978 Study, 1044 man-days of data from 150 subjects obtained during a Mediterranean operational period.

⁴Mean for number of subjects indicated ().

TABLE 4 DEMOGRAPHIC COMPARISON OF TEST POPULATIONS

	JULY - AUGUST	NOVEMBER 1978
No. of Subjects Studied	203	150
Distribution by Rank(%)		
E - 1	1.0	1.3
E - 2	12.8	10.0
E - 3	31.0	34.0
E - 4	28.1	28.0
E - 5	15.3	18.0
E - 6	11.8	8.7
Distribution by Department (%)		
Air	46.3	48.0
Operations	15.3	12.0
Engineering	12.8	14.0
Supply	14.3	14.0
Weapons	5.9	6.0
Deck	5.4	6.0
Distribution by Age Group		
18 - 20 years	13.3	17.3
20 - 25	57.6	55.3
25 - 30	13.3	18.0
Over 30	15.8	9.4
Distribution by Work Shift		
Days	52.9	71.3
Variable	30.1	12.7
Nights	17.0	16.0
Distribution by Physical Activity Level		
Light	29.9	32.7
Moderate	54.9	55.3
Heavy	15.2	12.0
Distribution by Marital Status		
Single	55.2	56.0
Married	39.9	40.7
Divorced	4.9	3.3

TABLE 5 ANTHROPOMETRIC SUMMARY USS SARATOGA 1977

Age	24.32	±	5.30 yrs ¹
Height	175.59	±	6.8 cm
Weight (initial)	76.19	±	13.6 kg
Weight (final)	75.84	±	13.0 kg
Weight change	-0.03	±	1.58 kg
Standard Weight	75.36	±	5.9 kg
Skinfold Thickness			
Right Triceps	12.70	±	4.9 mm
Left Triceps	11.05	±	4.3 mm
Right Scapula	14.89	±	6.6 mm
Left Scapula	14.41	±	6.2 mm
Percent Body Fat	19.47	±	5.1 %
Fat Free Mass	63.90	±	9.4 kg
Number of subjects (overweight)	50 (24.6%)		

¹Values are mean ± SD of 203 subjects.

²Values based upon age and height of military populations.

³Estimated for age, and skinfolds (Durnin-Womersley method using tricep and scapula skinfolds).

TABLE 6 ANTHROPOMETRIC SUMMARY
USS SARATOGA 1978

Age	23.79	±	5.26 yrs ¹
Height	175.64	±	7.04 cm
Weight	74.64	±	11.76 kg
Standard Weight ²	75.36	±	5.09 kg
SkinFold Thickness			
Right Tricep	11.44	±	4.37 mm
Right Bicep	5.86	±	2.50 mm
Right Scapula	14.31	±	5.54 mm
Right Supra-Iliac	22.59	±	8.27 mm
Percent Body Fat ³	18.51	±	4.80 %
Fat Free Mass ³	62.14	±	8.16 kg
Number of Subjects (Overweight)	23		(15.3%)

¹ Values are means ± SD of 150 subjects.

² Values based upon age and height of military populations.

³ Estimated by the Durnin-Womersley method using and sum of 2 skinfold.

TABLE 7 ANTHROPOMETRY AND GALLEY ATTENDANCE OF
USS SARATOGA SAILORS STUDIED EARLY AND AGAIN FOUR MONTHS LATER
IN THE MEDITERANEAN CRUISE

	DATE OF STUDY	
	NOV 1978	MAR 1979
Age (yrs)	23.3 ± 4.7 ¹	23.6 ± 4.7
Height (cm)	175.7 ± 7.2	175.7 ± 7.2
Weight (kg)	75.0 ± 12.2	74.6 ± 12.0
Weight Change (kg)		-0.35 ± 2.0
Sum Four Skinfolts (mm)	54.7 ± 18.7	53.7 ± 16.6
Body Fat (%) ²	19.6 ± 4.4	19.5 ± 4.0
Body Fat (kg)	15.1 ± 5.5	14.8 ± 5.1
No. Overweights ³	20 (16.9%)	16 (13.6%)
No. Subjects Studied	118	118
Aft Meals/wk ⁴	10.2 ± 5.1	10.9 ± 5.6
%	(62.3)	(65.0)
Forward Meals/wk ⁴	6.2 ± 4.1	5.8 ± 4.8
%	(37.7)	(35.0)
Total Meals/wk	16.3 ± 5.3	16.7 ± 4.9

¹Mean ± SD.

²Estimated by the Durnin-Womersley method using age and sum of 4 skinfolts.

³PerSUPERINST 6110. 2/A, 17 June 1976.

⁴From questionnaire.

TABLE 8
Anthropometry and Galley Attendance of USS Saratoga Sailors
Categorized According to Four-Month Body Weight Change

	Weight Loss ≥ 4 lbs	Weight Change ≤ 4 lbs	Weight Gain ≥ 4 lbs
No. of Subject	29(25%)	73(62%)	16(14%)
Age(yr) Nov 78	23.8 ± 4.8 ¹	23.1 ± 4.6	23.5 ± 5.4
Height (cm)	173.6 ± 7.2	176.2 ± 7.1	177.3 ± 7.5
Body Weight (kg)			
Nov 78	76.8 ± 10.5	74.2 ± 11.6	75.2 ± 17.0
Mar 79	73.8 ± 10.2	74.2 ± 11.5	78.1 ± 17.1
No. Overweight ²			
Nov 78	7	10	3
Mar 79	3	9	4
% Body Fat ³			
Nov 78	21.9 ± 3.5	18.8 ± 4.1	19.1 ± 6.1
Mar 79	20.7 ± 3.6	18.9 ± 3.8	19.8 ± 5.3
Aft Meals/wk ⁴			
Nov 78	10.4 ± 5.0	10.2 ± 5.2	9.5 ± 4.8
Mar 79	9.4 ± 5.4	11.4 ± 5.9	10.9 ± 5.6
Forward Meals/wk ⁴			
Nov 78	5.4 ± 4.1	6.5 ± 4.1	5.9 ± 4.0
Mar 79	5.5 ± 4.9	6.1 ± 4.8	5.4 ± 4.8
Bicep (mm)			
Nov 78	7.2 ± 2.5	5.4 ± 2.2	6.0 ± 3.3
Mar 79	6.5 ± 2.1	5.2 ± 2.1	6.3 ± 3.4
Tricep (mm)			
Nov 78	13.6 ± 4.1	10.8 ± 3.7	11.1 ± 6.0
Mar 79	12.2 ± 3.9	10.3 ± 3.6	11.6 ± 5.6
Scapula (mm)			
Nov 78	16.8 ± 5.5	13.5 ± 4.8	14.5 ± 7.7
Mar 79	15.6 ± 5.1	13.7 ± 4.8	14.8 ± 7.1
Supra-iliac (mm)			
Nov 78	27.2 ± 7.2	21.1 ± 7.8	22.4 ± 9.9
Mar 79	24.3 ± 7.0	22.0 ± 7.4	23.0 ± 7.8
Sum Four Skinfolts (mm)			
Nov 78	64.8 ± 16.8	50.8 ± 16.5	54.0 ± 24.8
Mar 79	58.6 ± 15.1	51.3 ± 16.6	55.8 ± 22.0
Total Meals/wk			
Nov 78	15.8 ± 5.4	16.7 ± 5.3	15.4 ± 5.3
Mar 79	14.9 ± 4.3	17.5 ± 5.1	16.4 ± 4.4

¹Mean ± S.D.

²Per BUPERINST 6100. 2A, 17 June 1976.

³Estimated by the Durnin-Womersley method using age and sum of 4 skinfolts.

⁴From questionnaire.

TABLE 9 Anthropometry and Galley Attendance of USS Saratoga Sailors Categorized According to Weight for Height Standards¹

	Weight for height standards				
	1st & 2nd		3rd	4th	Overweight
	Quartile		Quartile	Quartile	
No. of Subjects	433 (36%)		38 (32%)	17 (14%)	20 (17%)
Age (yrs) Nov 78	22.4 ± 3.6 ⁴		22.6 ± 4.0	24.4 ± 5.3	± 6.6
Height (cm) Nov 78	175.6 ± 6.5		174.7 ± 7.3	176.1 ± 7.3	± 8.7
Body Weight (kg)					
Nov 78	65.8 ± 5.6		72.8 ± 6.1	81.7 ± 7.5	± 11.3
Mar 79	66.1 ± 5.6		72.2 ± 6.2	80.8 ± 7.7	± 12.5
Weight change (kg)	0.32 ± 1.8		0.63 ± 2.0	0.85 ± 1.4	± 2.5
No. Wt loss > 4 lbs.	5 (12%)		11 29%	6 35%	7 (35%)
No. Wt change < 4 lbs	30 (70%)		23 60%	10 59%	10 (50%)
No. Wt Gain > 4 lbs.	8 (19%)		4 10%	1 (6%)	3 (15%)
% Body Fat ²					
Nov 78	16.5 ± 3.1		19.0 ± 3.0	22.1 ± 3.2	± 3.0
Mar 79	17.0 ± 3.3		18.8 ± 2.6	21.6 ± 3.7	± 2.7
Aft Meals/wk					
Nov 78	11.4 ± 5.4		9.6 ± 5.4	8.6 ± 3.5	± 4.6
Mar 79	11.6 ± 5.5		10.7 ± 5.6	10.4 ± 5.8	± 5.5
Forward Meals/wk					
Nov 78	6.0 ± 3.5		7.0 ± 4.3	5.7 ± 4.1	± 4.7
Mar 79	6.2 ± 4.9		6.3 ± 5.1	5.9 ± 5.3	± 3.6
Bicep (mm)					
Nov 78	4.4 ± 1.4		5.6 ± 1.8	6.6 ± 2.6	± 2.6
Mar 79	4.4 ± 1.4		5.1 ± 1.5	6.7 ± 2.2	± 2.8

TABLE 9 Anthropometry and Galley Attendance of USS Saratoga Sailors Categorized According to Weight for Height Standards
(Continued)

	1st & 2nd		3rd		4th		Overweight
	Quartile		Quartile		Quartile		
Tricep (mm)							
Nov 78	9.4	+	3.1	10.8	+	3.0	15.8
Mar 79	9.4	+	3.3	10.2	+	3.2	14.2
Scapula (mm)							
Nov 78	11.0	+	2.8	12.7	+	3.3	23.4
Mar 79	11.4	+	3.4	12.5	+	3.1	21.6
Supra+ilac (mm)							
Nov 78	16.9	+	5.1	21.9	+	7.1	32.7
Mar 79	18.3	+	5.4	21.8	+	5.8	30.6
Sum 4 skinfolds							
Nov 78	41.7	+	10.4	56.0	+	12.9	81.0
Mar 79	43.6	+	11.6	49.7	+	10.4	74.9
Total Meals/wk							
Nov 78	17.4	+	5.6	16.6	+	5.3	15.2
Mar 79	17.8	+	3.8	17.5	+	6.1	14.2

¹Per BUPERINST 6110 2A 17 Jun 1976, Quartiles formed by subdividing minimim and maximum weight for a given height into 4 narrow ranges (quartiles).

²Estimated by the Durnin-Womersley method using age and sum of 4 skinfolds.

³Individuals categorized from Nov 1978 study data.

⁴Mean±S.D.

TABLE 10
PERCENT OF DAILY CALORIES DURING MEALS AND SNACKS
FROM VARIOUS SOURCES USS SARATOGA 1977 (BEFORE FAST FOOD TEST)

Source	Percent of Daily Calories		
	Meals	Snacks	Total
Aft Galley	66.9	1.7	68.6
Forward Galley	19.3	0.6	19.9
Gedunk	0.7	5.4	6.1
Other	0.8	4.7	5.5
Total	87.7	12.4	100.1

TABLE 11 AVERAGE NUTRIENT INTAKE USS SARATOGA 1977

NUTRIENT	PER DAY		PER AFT MEAL		PER FORWARD MEAL	
Energy (kcal)	2040	610	950	206	976	2803
Protein (gm)	83	25	44	9	34	14
Fat (gm)	89	28	44	10	43	18
Percent Fat Calories	29.4	4.4	42.1	3.9	43.9	7.6
Percent Animal Fat	63.0	8.9	63.3	9.4	70.6	18.1
Percent Plant Fat	34.9	8.5	36.3	9.3	28.0	17.3
Percent Fish Fat	0.4	0.6	0.4	0.5	0.4	1.4
Cholesterol (mg)	458	198	257	87	147	100
Carbohydrate (gm)	227	78	93	26	88	31
Calcium (mg)	665	273	319	120	271	140
Phosphorus (gm)	1204	362	589	133	482	180
Ca:P Ratio	.54	.11	.53	.12	.56	.18
Iron (mg)	14.5	5.0	6.7	1.5	5.9	2.6
Vitamin A (IU)	3785	2529	2105	1296	854	586
Thiamin (mg)	1.6	4.0	0.6	0.2	0.5	0.2
Riboflavin (mg)	1.8	3.4	0.8	0.2	0.6	0.2
Niacin (mg)	17.2	8.2	8.3	2.0	6.5	3.3
Ascorbic Acid (mg)	63.2	51.2	31.5	14.7	15.1	13.5

¹ Values are mean \pm SD for 203 subjects.

TABLE 12 EVALUATION OF AVERAGE NUTRIENT INTAKES
USS SARATOGA 1977

Nutrient	Percentage of Population ¹		
	Low ²	Marginal ²	Adequate ²
Aft Galley			
Protein	0	0	100
Calcium	5.4	17.8	76.7
Iron	0	4.5	95.5
Vitamin A	8.9	27.7	63.4
Thiamin	0.5	12.4	87.1
Riboflavin	0	12.4	87.6
Niacin	0	5.4	94.6
Vitamin C	2.0	9.9	88.1
No. of Subjects	184		
Forward Galley			
Protein	0.5	15.2	84.2
Calcium	16.8	23.9	59.2
Iron	1.6	25.0	73.4
Vitamin A	69.0	20.1	10.9
Thiamin	1.1	31.5	67.4
Riboflavin	0.5	44.0	55.4
Niacin	4.9	32.6	62.5
Vitamin C	48.9	13.6	37.5
No. of Subjects	202		
Daily Totals			
Protein	0	4.9	95.1
Calcium	1.5	21.2	77.3
Iron	0	5.4	94.6
Vitamin A	20.7	33.0	46.3
Thiamin	1.0	28.6	70.4
Riboflavin	1.0	25.6	73.4
Niacin	0.5	13.8	85.7
Vitamin C	7.4	15.3	77.3
No. of Subjects	203		

¹Values are based on nutrient ratios of subjects included who ate at least one AFT or Forward galley meal.

²See Text.

TABLE 13 AVERAGE INTAKES AT BREAKFAST, LUNCH, DINNER IN THE AFT
AND FORWARD GALLEYS USS SARATOGA 1977

	BREAKFAST		LUNCH		DINNER	
	AFT	Forward	AFT	Forward	AFT	Forward
Energy (Kcal)	762*	589	1002*	962	995*	942
Protein (gm)	32.6	16.5	48.1	38.8	45.7	38.7
Calcium (mg)	382.5*	307.6	309.2	274.5	290.3	259.1
Iron (mg)	5.6*	3.9	6.9**	6.4	6.9**	6.4
Vitamin A (IU)	1277.0*	857.8	1853.6*	870.7	3003.0*	812.3
Thiamin (mg)	.50*	.34	.67*	.52	.51	.54
Riboflavin (mg)	.78*	.51	.75*	.64	.73*	.63
Niacin (mg)	4.0*	2.1	9.5*	7.5	9.6*	7.8
Vitamin C (mg)	28.1	24.5	33.8*	15.0	33.2*	13.4
Fat Calories (%)	43.1*	28.4	42.1	46.1	40.4	46.3
Cholesterol (mg)	482*	162	176*	144	160**	141
Animal Fat (%)	70.2	32.2	57.8	75.8	62.4	76.4
Plant Fat (%)	30.3	69.4	41.0	22.2	37.2	21.8
Fish Fat (%)	-	-	0.5	0.3	0.4	0.5
Number of Subjects	180	104	197	146	195	161

¹ Values are means of subjects shown who consumed at least one meal at galley indicated during the 17 day study period.

* p < .01

** p < .05

TABLE 14 EVALUATION OF FORWARD AND AFT GALLEY MEAL
USS SARATOGA 1977

Nutrient	Percentage of Population ¹			
	Forward Galley		Aft Galley	
	Low ²	Adequate ²	Low ²	Adequate ²
Breakfast				
Protein	26.9	35.6	2.8	91.1
Calcium	16.3	77.9	1.1	94.4
Iron	31.7	39.4	5.0	81.1
Vitamin A	37.5	34.6	10.6	49.4
Thiamin	8.7	65.4	0.6	87.8
Riboflavin	15.4	67.3	1.1	94.4
Niacin	80.8	6.7	43.9	17.2
Vitamin C	44.2	47.1	31.1	58.9
No. of Subjects		104		108
Lunch				
Protein	0.7	85.6	1.0	97.5
Calcium	26.7	47.3	18.3	61.4
Iron	2.7	74.0	0	89.8
Vitamin A	75.3	9.6	28.9	51.8
Thiamin	6.2	65.8	5.1	74.6
Riboflavin	2.7	43.8	2.5	73.6
Niacin	2.1	63.0	0.5	95.4
Vitamin C	64.4	26.0	9.1	78.7
No. of Subjects		146		197
Dinner				
Protein	0.6	85.7	0	99.5
Calcium	30.4	46.6	20.0	50.8
Iron	2.5	76.4	0.5	93.8
Vitamin A	78.3	11.2	15.9	66.7
Thiamin	3.7	64.6	6.7	47.7
Riboflavin	5.0	47.2	3.6	63.6
Niacin	3.7	72.0	0.5	98.5
Vitamin C	66.5	22.4	6.7	84.1
No of Subjects		161		195

¹Values are based on nutrient ratios of subjects indicated who ate at least one breakfast, lunch or dinner meal at the aft or forward galley.

²See text.

TABLE 15 EVALUATION OF NON-GALLEY NUTRITION
USS SARATOGA 1977

NUTRIENT	PERCENTAGE OF POPULATION ¹		ADEQUATE ²
	LOW ²	MARGINAL ²	
Protein	78.6	14.3	7.1
Calcium	19.4	38.3	42.3
Iron	76.0	10.7	13.3
Vitamin A	91.3	3.6	5.1
Thiamin	89.3	6.1	4.6
Riboflavin	73.5	8.2	18.4
Niacin	68.4	6.6	25.0
Vitamin C	77.0	3.6	19.4

¹196 subjects who reported consuming foods and beverages from sources other than from Aft and Forward Galley meals.

²See Text.

TABLE 16 COMPARISON OF EATING HABITS OF SUBJECTS WITH LOW,
MARGINAL, OR ADEQUATE DAILY VITAMIN A
INTAKES USS SARATOGA 1977

	DAILY VITAMIN A INTAKES		
	LOW ¹	MARGINAL ¹	ADEQUATE ¹
Number of Subjects	41	63	99
Percent of Daily Calories			
Aft Meals	52	67	76
Forward Meals	25	20	14
Snacks	19	12	10
Vitamin A Ratio			
Aft Meals	0.73	1.06	1.97
Forward Meals	0.57	0.69	0.77

¹See Table.

TABLE 17 FOOD TYPE CONSUMPTION OF SUBJECTS WITH LOW,
MARGINAL OR ADEQUATE DAILY VITAMIN A
INTAKES USS SARATOGA 1977

Quantity (gm/day) Consumed by Subjects whose Daily Vitamin A Intakes were:			
	LOW ¹	MARGINAL ¹	ADEQUATE ¹
Number of subjects	41	63	99
Milk	137	236	178
Cheese and Ice Cream	19	29	31
Tomato Products	9	25	38
Carrots, Raw and Cooked	0.2	1.5	8
Sweet Potatoes	0.3	1.8	2.0
Liver	0	0	0
Leafy Green Vegetables	6	14	31
Melons, Peaches, Plums	11	12	28
Eggs	24	41	42
Potatoes, French Fries	8	11	11

¹See Text

TABLE 18 AVERAGE NUTRIENT INTAKE USS SARATOGA NOVEMBER 1978

NUTRIENT	PER		PER		PER	
	DAY		DAY		DAY	
Energy (Kcal)	2895	848 ¹	1286	365 ²	1224	382 ³
Protein (gm)	121	37	59	19	56	20
Fat (gm)	141	45	69	22	61	22
Percent Fat Calories	43.8	4.4	47.9	5.7	44.7	6.0
Percent Animal Fat	70.0	10.0	76.5	11.1	66.8	15.7
Percent Plant Fat	27.1	9.2	22.6	10.3	31.4	15.1
Percent Fish Fat	0.6	1.4	0.8	1.9	0.3	0.6
Cholesterol (mg)	566	230	332	158	196	73
Carbohydrate (gm)	289	94	106	36	114	39
Calcium (mg)	1401	583	619	279	653	353
Phosphorus (mg)	1949	620	884	283	874	325
Ca:P Ratio	.71	.14	.69	.17	.72	.21
Iron (mg)	18.3	5.6	8.4	2.5	6.92	2.3
Vitamin A (IU)	5039	2405	2463	1307	1931	1114
Thiamin (mg)	1.5	0.6	0.7	0.3	0.7	0.3
Riboflavin (g)	2.7	1.0	1.2	0.4	1.2	0.5
Niacin (mg)	24.4	7.7	10.8	3.6	11.2	4.3
Ascorbic Acid (mg)	72.9	41.3	31.2	21.3	26.8	19.1
Number of Subjects	150			144		140

¹Values are mean \pm SD for 150 subjects.²Values are mean \pm SD for number of subjects who ate at least one Aft Galley meal.³Values are mean \pm SD for number of subjects who ate at least one Forward Galley meal.

TABLE 19 EVALUATION OF AVERAGE NUTRIENT INTAKES
USS SARATOGA 1978

Nutrient	Low ²	Percentage of Population ¹	
		Marginal ²	Adequate ²
Aft Galley			
Protein	0	2.1	97.9
Calcium	2.1	9.7	88.2
Iron	0	19.4	80.6
Vitamin A	9.7	32.6	57.6
Thiamin	6.3	36.1	57.6
Riboflavin	1.4	6.9	91.7
Niacin	0.7	14.6	84.7
Vitamin C	16.7	25.0	58.3
No. of Subjects	144		
Forward Galley			
Protein	0	2.9	97.1
Calcium	4.3	4.3	91.4
Iron	5.7	50.0	44.3
Vitamin A	28.6	27.1	44.3
Thiamin	2.9	37.1	60.0
Riboflavin	2.1	15.0	82.9
Niacin	1.4	5.7	92.9
Vitamin C	25.7	16.4	57.9
No. of Subjects	140		
Daily Totals			
Protein	0	1.3	98.7
Calcium	0.7	2.7	96.7
Iron	0.7	23.3	76.0
Vitamin A	12.0	35.3	52.7
Thiamin	6.0	36.7	57.3
Riboflavin	0.7	10.7	88.7
Niacin	0.7	11.3	88.0
Vitamin C	12.0	27.3	60.7
No. of Subjects	150		

¹Values are based on nutrient ratios of subjects included who ate at least one Aft or Forward galley meal.

²See Text.

TABLE 20 AVERAGE INTAKES AT BREAKFAST, LUNCH, DINNER IN THE AFT
AND FORWARD GALLEYS USS SARATOGA 1978

	BREAKFAST		LUNCH		DINNER	
	AFT	FORWARD	AFT	FORWARD	AFT	FORWARD
Energy (Kcal)	9741	709	1402	1307	1345	1318
Protein (gm)	39.4*	22.5	67.5*	57.3	62.3	64.3
Calcium (mg)	705.9**	595.8	560.9	625.8	596.8	678.1
Iron (mg)	6.9	7.0	9.0*	7.0	8.3	6.8
Vitamin A (IU)	1800.8*	2583.9	2057.6	1805.1	3272.1*	1804.6
Thiamin (mg)	.70	.85	.71	.70	.62	.63
Riboflavin (mg)	1.4	1.5	1.2	1.1	1.1	1.2
Niacin (mg)	5.6*	8.4	12.9	10.7	11.9	12.3
Vitamin C (mg)	31.7	44.8	27.8	22.7	31.4	24.1
Fat Calories (%)	43.1*	31.5	50.2*	47.4	48.1*	44.9
Cholesterol (mg)	482*	91	285*	196	248*	227
Animal Fat (%)	83.7**	75.1	77.3	68.7	68.4	62.4
Plant Fat (%)	15.1	24.9	21.6	30.2	30.6	34.8
Fish Fat (%)	0.1	-	0.8	0.3	1.1	0.4
No. of Subjects	106	55	115	105	121	126

*Values are means of number subjects shown who consumed at least one meal at the galley indicated during the 7-day study period.

** p<.05

* p<.01

TABLE 21 EVALUATION OF FORWARD AND AFT
GALLEY MEALS USS SARATOGA 1978

Nutrient	Percent of Population			
	Forward Galley		Aft Galley	
	Low [†]	Adequate [†]	Low [†]	Adequate [†]
Breakfast				
Protein	3.6	52.7	3.8	78.3
Calcium	0	98.2	3.8	93.4
Iron	16.4	72.7	11.3	67.9
Vitamin A	12.7	81.8	12.3	54.7
Thiamin	1.8	90.9	.9	85.8
Riboflavin	0	98.2	.9	97.2
Niacin	20.0	70.9	46.2	25.5
Vitamin C	18.2	78.2	51.9	41.5
Number of Subjects		55		106
Lunch				
Protein	1.0	90.5	0	98.3
Calcium	7.6	82.9	11.3	77.4
Iron	6.7	41.9	.9	78.3
Vitamin A	47.6	31.4	36.5	29.6
Thiamin	3.8	55.2	23.5	40.9
Riboflavin	4.8	71.4	5.2	80.9
Niacin	1.0	85.7	2.6	91.3
Vitamin C	35.2	43.8	21.7	45.2
Number of Subjects		105		115
Dinner				
Protein	0	98.4	0	96.7
Calcium	9.5	88.1	9.9	82.6
Iron	13.5	32.5	7.4	69.4
Vitamin A	40.5	32.5	15.7	65.3
Thiamin	7.9	34.9	24.0	24.8
Riboflavin	5.6	74.6	4.1	79.3
Niacin	0	89.7	6.6	83.5
Vitamin C	29.4	50.8	23.1	58.7
Number of Subjects		126		121

[†] Values are based on nutrient ratios of subjects indicated who ate at least one breakfast, lunch, or dinner meal at the aft or forward galley. See Text.

TABLE 22 FAST FOODS AND BEVERAGES AVAILABLE AT
FORWARD GALLEY MEALS USS SARATOGA 1978

<u>BREAKFAST</u>	<u>LUNCH AND DINNER</u>
Dry Cereals (fortified)	Fried Chicken
Sweet Roll	Hot Dogs
Milk	Chili Dogs
Juice	Pizza
	Cheese Chunks
	Milk
	Cheeseburger
	Hamburger
	Submarine Sandwiches
	Fish Portions
	Shrimp
	Carbonated Beverages
	Non-Carbonated Beverage
	French Fries (extruded, vitamin C fortified)*
	Milk Shakes (dry base, vitamin A fortified)**

*25.7 mg vitamin C 100 gm fried product; **712 IU vitamin A/100 gm dry base.

TABLE 23
 PERCENTAGE OF DAILY INTAKE OF VITAMIN A AND
 VITAMIN C OBTAINED FROM FORTIFIED FOODS USS SARATOGA 1978

FORTIFIED FOODS	PERCENTAGE OF DAILY INTAKE FROM FORTIFIED FOODS		
	AVERAGE TOTAL INTAKE g/day	VITAMIN A	VITAMIN C
Milk Shake	79.5 ¹	9.4	-
Soft Serve			
Ice Cream	17.2	2.4	-
French Fries	41.1	-	15.5
Dry Cereals	10.4	9.5	7.7
TOTAL	20.3	23.2	

¹Mean of 150 subjects.

TABLE 24 SELECTION RATE OF BEVERAGES DURING
MEALS USS SARATOGA 1978

BEVERAGE	SELECTION RATE (%) ¹			
	FORWARD GALLEY		AFT GALLEY	
	LUNCH	SUPPER	LUNCH	SUPPER
Milk Shake	50	56	-	-
Milk	37	34	30	75
Non-carbonated Beverage	47	53	46	48
Carbonated Beverage	30	32	7	12
Coffee, Tea	3	3	10	9

¹Number of subjects who selected a beverage at least once with a meal
÷ number of subjects who ate at least one meal X 100.

TABLE 25 PREFERENCE OF FOOD TYPE WHEN SERVED AT FORWARD
GALLEY USS SARATOGA 1978

FOOD TYPE	PREFERENCE AT FORWARD GALLEY	
	LUNCH MEALS ¹	DINNER MEALS ¹
Cheeseburger, Hamburger	64% (8)	59% (8)
French Fries	57% (8)	64% (8)
Submarine Sandwiches	28% (8)	20% (1)
Hot Dog, Chili Dog	18% (3)	15% (1)
BBQ Sandwich	42% (1)	-
Chicken	-	40% (3)
Fish	-	20% (3)
Pizza	-	39% (2)
Shrimp	-	42% (1)
Milk Shake	33% (8)	36% (7)
Milk	22% (8)	21% (8)
Carbonated Beverage	25% (8)	18% (8)
Non-carbonated Beverage	30% (8)	36% (8)

¹Values are number of times a food type was eaten ÷ the number of meals eaten when the food type was served X 100. Values in parenthesis represent number of times served during 8-day study.

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